



# Preyfish Population Assessment

*The USGS Great Lakes Science Center is dedicated to providing scientific information for restoring, enhancing managing and protecting living resources and their habitats in the Great Lakes region.*

*The Center is headquartered in Ann Arbor, Michigan, and has biological stations and research vessels located throughout the Great Lakes Basin.*



The USGS Great Lakes Science Center conducts annual trawl surveys in all five Great Lakes to assess the health of populations of both predator and prey species. This monitoring leads to a better understanding of the processes that shape the fish community and to identify those characteristics critical to each species.



The exotic alewife, a dominant preyfish species in every Great Lake with the exception of Superior.

Throughout the years, stocking programs for lake trout, Pacific salmon and other salmonids have been established to rehabilitate those populations left devastated by sea lamprey predation and over fishing, and these programs are vital to the reestablishment of these economically valuable apex predators. These species are sustained by preyfish populations of alewife, rainbow smelt, bloaters, sculpin and lake herring. The assessment of the preyfish populations is vital in management decisions regarding these apex predators.

## State of the Ecosystems

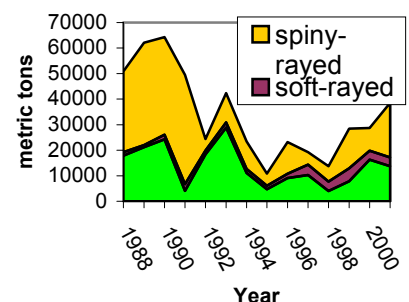
The preyfish assemblage forms important trophic links in the aquatic ecosystem and constitutes the majority of the fish production in the Great Lakes. However, preyfish populations vary with each lake. Lake Erie, the warmest and shallowest lake, is the most productive and has the highest species diversity of preyfish. In contrast, Lake Superior is a deep, cold and relatively unproductive lake; unique in that it is the only lake that can support a naturally reproducing population of lake trout.



R/V Kiyi, the Great Lakes Science Center's largest and newest vessel, conducts surveys and research on Lake Superior. The Center also has large ships on Lakes Erie, Huron, Michigan, and Ontario.

In 2002, scientists from the Great Lakes Science Center assessed the health of the populations of preyfish for the biennial State of the Lakes Ecosystem Conference (SOLEC) to provide information to policy makers on the status of the lakes and future needs. Preyfish population is one of

the 80 indicators used by SOLEC to determine the health of the lakes. Based on the variety of indicators, Lake Superior's condition has been assessed as mixed and improving. Unfortunately, the status of the other four lakes has been assessed as mixed and deteriorating.



Lake Erie biomass of forage fish species. Spiny-rayed fish include young yellow perch, white perch and white bass; soft-rayed include trout perch and emerald and spottail shiners; and clupeid are young gizzard shad and alewife.

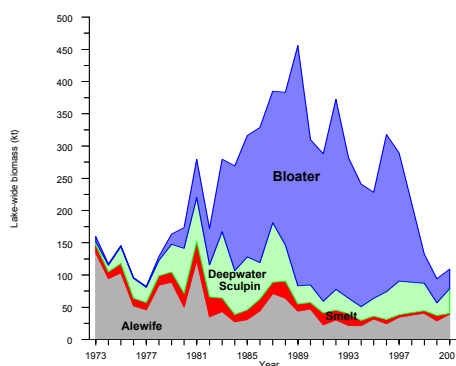
## Lake Erie

A species-rich and highly productive lake, Lake Erie has shown declines in recruitment of forage fish in recent years most likely due to an increase in invasive zebra mussel colonization. These mussel populations filter food out of the water column and reduce the available resources for small fish.

## Lake Michigan

Lake Michigan species have been experiencing some declines in recent years, some due to natural cycles in abundance, others because of high predation pressure. Bloaters seem to be experiencing these natural cycles, they have been steadily declining since 1990, but are expected to rebound in the next few years. The non-native rainbow smelt and alewife have declined possibly in response to predation by stocked salmonids.

Disturbing declines in yellow perch and *Diporeia* (a small crustacean many fish use as a primary food )



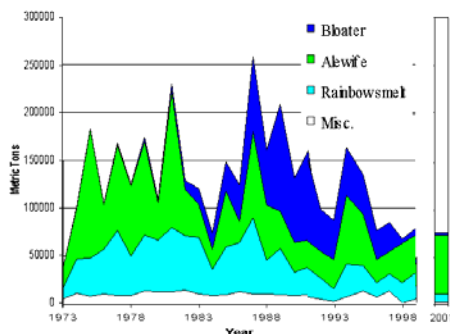
Lake Michigan preyfish biomass.

have been attributed to increasing zebra mussel colonization and the disruptions they cause to the food web. Another invasive that could potentially impact the preyfish community is the round goby, a highly competitive benthic fish from Eurasia, which is colonizing increasingly deeper areas of the lake.

## Lake Huron

Similar to Lakes Michigan and Erie, Lake Huron has been experiencing the negative impacts of the zebra mussel invasion, as well as the arrival of the round goby. Lake Huron's fish community is dominated by non-native species, such as alewife and smelt and predation pressure by salmonids predominantly determines their populations.

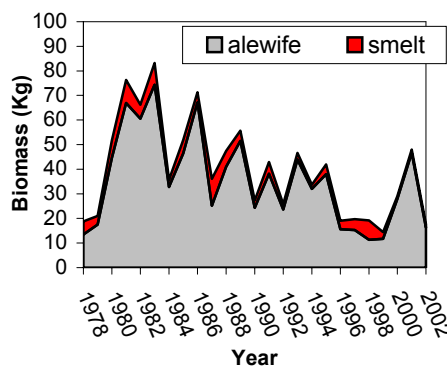
Bloater populations have been declining as alewives become the most abundant preyfish.



Lake Huron's prey fish biomass. Sampling was not completed in the year 2000.

## Lake Ontario

Dominated by alewives and rainbow smelt, Lake Ontario's food web has been particularly damaged by invasive species. Populations of forage fish have moved to increasingly deeper waters as zebra and quagga mussels colonized most of the lake bottom, and currently the fish species remain in the deeper water. Slimy sculpin populations declined sharply coincident with the collapse of *Diporeia* (most likely caused by zebra mussels) and no deepwater sculpin were caught at all in 2000-2001. Scientists consider Lake Ontario's condition to be the worst of the lakes.



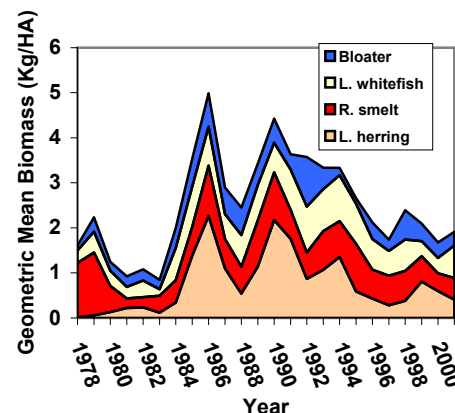
Lake Ontario's preyfish biomass, dominated by 2 non-native species, alewife and smelt.



Deepwater sculpin, a common forage fish in Lakes Ontario, Michigan and Huron, their numbers are declining due to competition with round gobies.

## Lake Superior

Not significantly impacted by zebra mussels due to cold water temperatures, Lake Superior is the



Lake Superior preyfish biomass.

bright spot on this bleak report. Lake Superior's condition has been improving over the last few years, and declines in prey fish are the result of a recovery in wild lake trout stocks, not of worsening conditions.

Lake trout were decimated by over-fishing and sea lamprey predation, and had fallen to historical lows in the 1960's. Recovery began in the mid-1980's and some species, particularly sculpins, burbot, and stickleback have been declining since under heavy predation pressure. Bloater biomass has nearly doubled since the early 1980's, and lake herring has recovered to a point where the commercial fishery could be re-established.